LUMEL

DIGITAL-TO-ANALOGUE METER WITH A MULTICOLOUR BARGRAPH + SERIAL INTERFACE

NA3 TYPE

USER'S GUIDE

CE

DIGITAL-TO-ANALOGUE METER WITH A MULTICOLOUR BARGRAPH + SERIAL INTERFACE

NA3 TYPE

CONTENTS Page

1. APPLICATION 5
2. SET OF THE METER 6
3. BASIC REQUIREMENTS, OPERATIONAL SAFETY 7
4. INSTALLATION 9
5. SERVICING 11
6. RS-485 INTERFACE 28
7. TECHNICAL DATA 45
8. BEFORE A FAILURE HAS BEEN DECLARED 49
9. EXAMPLES OF NA3 METER PROGRAMMING 50
10. ORDERING PROCEDURE 52
11. MAINTENANCE AND GUARANTEE 56

1. APPLICATION

NA3 series meters with a multicoloured bargraph have an universal input destined to measure temperature, resistance, voltage from shunts, standard signals, d.c. voltage and d.c. current.

NA3 meters can optionally have a continuous analogue output, relays, OC type (Open Collector) and digital RS-485 outputs.

They can find application in various industrial fields, e.g. food industry, intermediate pumping stations, sewage treatment plants, chemical industry, weather stations, breweries.

NA3 meters are executed in three basic versions:

- NA3-F with a 4-digit LED readout field (digit height: 7 mm) and a multicolour bargraph,
- NA3-D with a 4-digit LED readout field (digit height: 14 mm),
- NA3-B with a multicolour bargraph.

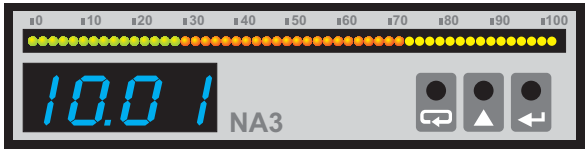
The type choice is made in the execution code.

They are programmed by means of the keyboard and through RS-485. Meters only with the bargraph can be programmed through RS-485.

NA3 meters realise following functions:

– measurement of the input quantity and displaying it on the display and/or the bargraph,
– evaluation of the input signal into indication on the base of the individual linear characteristic,
– programming of the colour and bargraph resolutions (no concerns NA3-D),
– signalling of alarm value setting exceeding,
– recording of the measured signal in programmed time segments,
– storage of maximal and minimal values,
– programming of the indication resolution,
– programming of the measurement averaging time,
– locking of the parameter introduction by means of a password,
– conversion of the measured quantity into a voltage or current output signal,
– service of the RS-485 interface in MODBUS protocol, both in ASCII and RTU mode.

a)



b)

c)

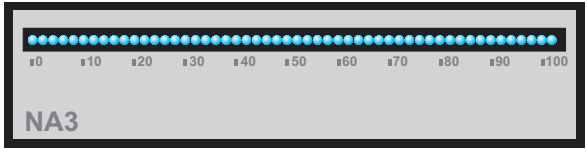


Fig.1. View of the NA3 meter: a) NA3-F, b) NA3-D, c) NA3-B

2. SET OF THE NA3 METER

We deliver in the set:
- NA3 meter ..... 1 pc.
- user's guide ..... 1 pc.
- guarantee card ..... 1 pc.
- plug with screw terminals ..... 1 pc
- holders to fix the indicator in the panel ..... 2 pcs
- set of stickers with units ..... 1 pc.

When unpacking the meter, please check whether the type and execution code on the data plate correspond to the order.

3. BASIC REQUIREMENTS, SAFETY INFORMATION

Symbols located in this service manual mean:

WARNING!

Warning of potential, hazardous situations. Especially important. One must acquaint with this before connecting the NA3 meter. The non-observance of notices marked by these symbols can occasion severe injuries of the personnel and the damage of the instrument.

CAUTION!

Designates a general useful note. If you observe it, handling of the meter is made easier. One must take note of this when the instrument is working inconsistently to the expectations.

Possible consequences if disregarded !

In the security scope the NA3 meter meets the requirements of the EEC Low-Voltage directive (EN 61010 -1 issued by CENELEC).

Remarks concerning the operator safety:

1. General

- The NA3 meter is destined to be mounted on a panel.
- Non-authorized removal of the required housing, inappropriate use, incorrect installation or operation creates the risk of injury to personnel or damage to equipment. For more detailed information please see the user's guide.
- All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel and national regulations for the prevention of accidents must be observed.
- According to this basic safety information, qualified, skilled personnel are persons who are familiar with the installation, assembly, commissioning, and operation of the product and who have qualifications necessary for their occupation.

2. Transport, storage

Please observe the notes on transport, storage and appropriate handling. Observe the climatic conditions given in Technical Data.

3. Installation

- The NA3 meter must be installed according to the regulation and instructions given in this service manual.

- Ensure proper handling and avoid mechanical stress.
- Do not bend any components and do not change any insulation distances.
- Do not touch any electronic components and contacts.
- Instruments may contain electrostatically sensitive components, which can easily be damaged by inappropriate handling.
- Do not damage or destroy any electrical components since this might endanger your health!

4. Electrical connection

- Before switching the meter on, one must check the correctness of connection to the network.
- In case of the protection terminal connection with a separate lead one must remember to connect it before the connection of the instrument to the mains.
- When working on live instruments, the applicable national regulations for the prevention of accidents must be observed.
- The electrical installation must be carried out according to the appropriate regulations (cable cross-sections, fuses, PE connection). Additional information can be obtained from the user's guide.
- The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must be observed for all CE-marked products.
- The manufacturer of the measuring system or installed devices is responsible for the compliance with the required limit values demanded by the EMC legislation.

5. Operation

- Measuring systems including NA3 meters must be equipped with protection devices according to the corresponding standard and regulations for prevention of accidents.
- After the instrument has been disconnected from the supply voltage, live components and power connections must not be touched immediately because capacitors can be charged.
- The housing and the door must be closed during operation.

6. Maintenance and servicing

Please observe the manufacturer's documentation.

Read all product-specific safety and application notes in this user's guide manual

- Before taking the meter housing out, one must turn the supply off.

- The removal of the instrument housing during the guarantee contract period may cause its cancellation.

4. INSTALLATION

4.1. Fitting

Prepare a ($22.2^{+0.5}$ x $92^{+0.5}$) mm hole in the panel. The thickness of the material from which the panel is made should be in the range 1...15 mm.

The meter has screw terminal strips which enable the connection of 2.5 mm^2 cross-section external conductors.

Meter dimensions are shown on the fig. 2.

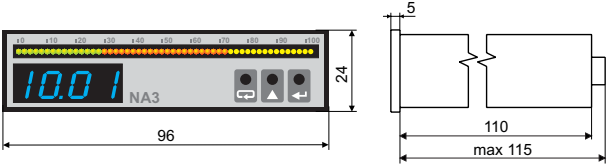
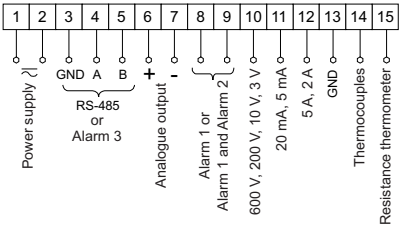


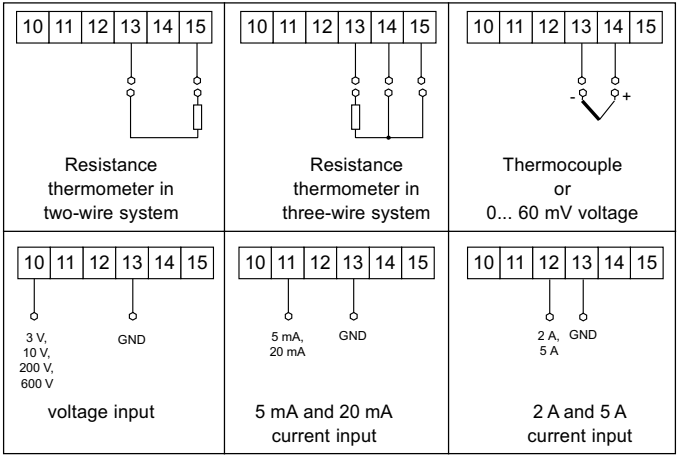
Fig. 2. Meter overall dimension

4.2. External connection diagrams

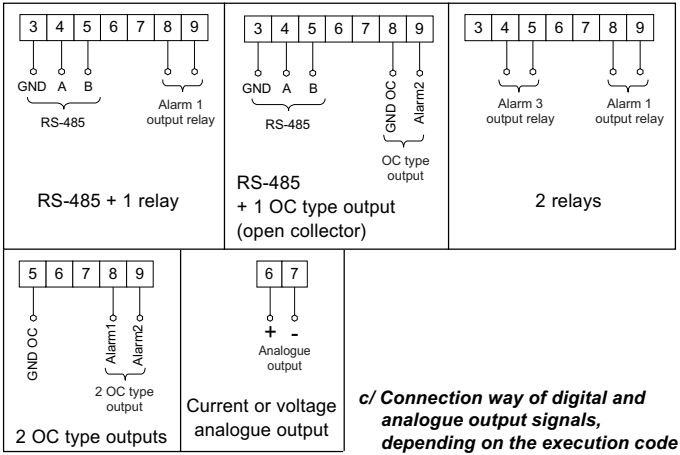
The description of terminal strips are shown on the fig. 3a.



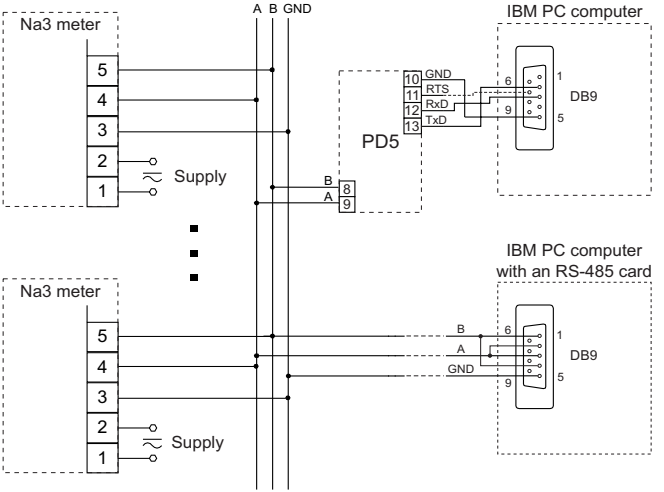
a/ Description of the terminal strip



b/ Connection way of input signals



c/ Connection way of digital and analogue output signals, depending on the execution code



d/ Connection way of the RS-485 interface

Fig.3 External connections of the NA3 meter

Taking into consideration electromagnetic interference it is recommended to use shielded conductors for the connection of input and output signals.

The power supply must be connected by means of a two-wire conductor with a suitable cross-section ensuring its protection by means of a fuse element.

Requirements concerning the power supply cable are regulated by EN 61010-1 p. 6.10. standard.

5. SERVICING

After connecting external signals and switching the meter on, its name NA-3 and also the current version of the program, e.g. r 1.00 are displayed.

After ca 3 seconds, the meter is transiting automatically into the working mode in which it carries out the measurement and the display of the measured value on the display and the bargraph. Depending on alarm and bargraph parameter settings, alarm thresholds are also displayed on the bargraph. The meter blanks automatically insignificant zeros.

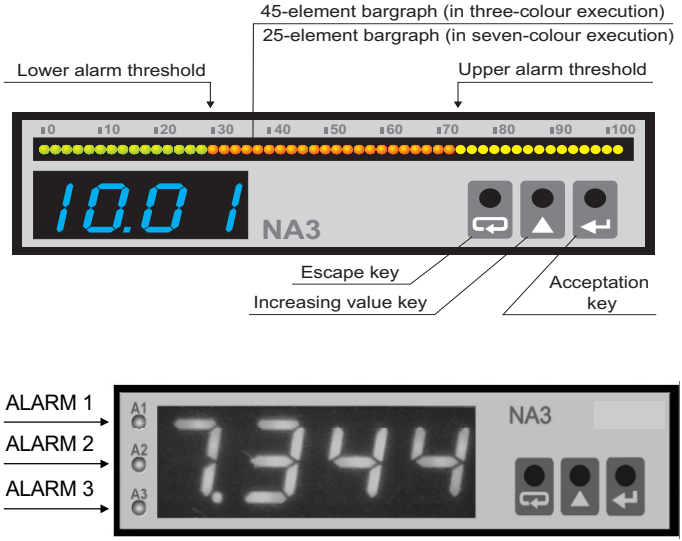


Fig. 4 Description of the NA3F and NA3D frontal plate.

Key functions:

[↵] - acceptation key

- entry into the programming mode (hold down during ca 3 seconds),
- entry into the chosen parameter level,
- entry into the changing mode of the parameter value,
- acceptation of the changed parameter value.

[▲] - Key to increase the value

- display of the minimal value (first pressure), maximal (second pressure), return to measurement (third pressure),
- mowing on the preview menu or programming matrix,
- change of the chosen parameter value - increasing of the value.

[ESC] - Escape key

- entry into the menu of parameter preview (hold down ca 3 seconds),
- exit from the preview menu or programming matrix,
- escape from the parameter change.

The pressure and hold down the [↵] key during 3 seconds causes the entry into the programming mode. The programming mode is protected by the SEC safety code.

The pressure and hold down the [ESC] key during 3 seconds causes the entry into the preview menu. One must move on the preview menu by means of the [▲] key. In this menu, only all programmed parameters, except servicing parameters, are accessible to readout. The exit from the preview menu is operated by means of the [ESC] key.

In the preview menu, it is also possible to review recorded rESL values. The pressure of the [↵] key on the rESL parameter causes the entry into the preview menu of recorded values. The number of the recorded result is displayed alternately with the value e.g. n320/2 174 The moving on recorded values takes place by means of the [▲] key. The hold down of this key longer than ca 2 seconds will cause the acceleration of the review. The pressure of the [↵] key in any time will cause the display of the number of recorded results. The exit from the review of recorded values is operated by means of the [ESC] key.

The algorithm of the meter servicing is presented on the fig. 5.

The appearance of the following symbols and inscriptions on the display means:

Err	Incorrectly introduced safety code
- - - -	Exceeding of the upper measuring range or lack of sensor
_ _ _ _	Exceeding of the lower measuring range or short-circuited sensor
ErrC	Error of the conductor resistance compensation. No connected conductor or damaged conductor.

It is possible to change meter parameters:
- from the meter keyboard (only in NA3-F and NA3-D executions) ..... - p. 5.1
- through RS-485 ..... - p.6.

5.1. Change of the NA3 meter parameters from the keyboard

The pressure of the [↵] key during ca three seconds causes the display of the SEC inscription alternately with the set value 0 by the manufacturer. The introduction of the correct code causes the entry into the programming mode. The fig.6 represents the transition matrix into the programming mode. One can move on groups of main parameters eg: **Chn**, **bAr1**, **Al1**, **Al2**, etc, by means of the [▲] key.

The pressure of the [↵] key on the given level, causes the entry into parameters of this level. The moving on the given level is operated by means of the [▲] key.

In order to change the value, one must use the [↵] key. In order to escape from the parameter change, one must press the [↩] key.

By means of the [↩] key, one can exit from the selected level and programming matrix to the measurement.

During the meter operation in the programming mode the measurement result is displayed on the bargraph, except the selection of the display testing function.

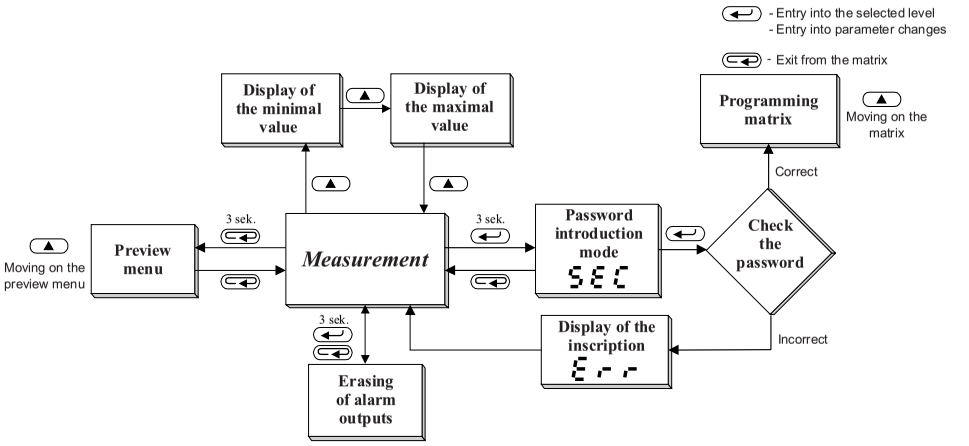
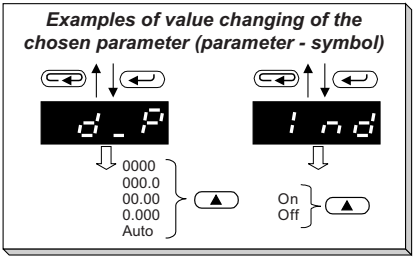


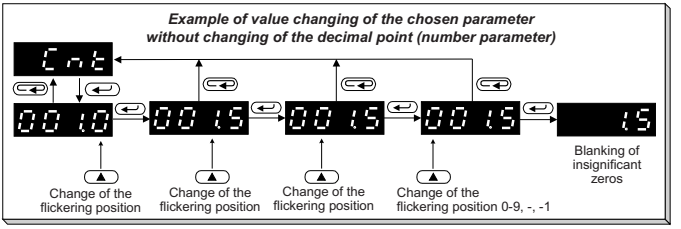
Fig 5. Servicing algorithm of the NA3 meter.

Item	Main menu	Parameters of the selected level									
1	Chn	tYP Input type	Func Math. functions	Con Kind of compens.	d_P Decim. points	Cnt Measur. time	Ind1 Input individ. charact.	1_H1 Param. of ind. charact.	d_Y1 Param. of ind. charact.	1_H2 Param. of ind. charact.	d_Y2 Param. of ind. charact.
2	bAr	tYPb Bargraph type	coLr Bargraph colour	brL Lower bargraph	brH Upper bargraph						
3	AL 1	PrL Lower threshold	PrH Upper threshold	tYPA Alarm type	dLY Alarm delay	HOLd Alarm support	CurL Lower colour	CurH Upper colour			
4	AL2	PrL Lower threshold	PrH Upper threshold	tYPA Alarm type	dLY Alarm delay	HOLd Alarm support	CurL Lower colour	CurH Upper colour			
5	AL3	PrL Lower threshold	PrH Upper threshold	tYPA Alarm type	dLY Alarm delay	HOLd Alarm support	CurL Lower colour	CurH Upper colour			
6	Out	Ind0 Output indiv. charac.	d_H1 Param. of indiv. charac.	0_Y1 Param. of indiv. charac.	d_H2 Param. of indiv. charac.	0_Y2 Param. of indiv. charac.	bAud Baud rate	trYb Kind of transm.	Adr Device adress		
7	SEr	SEt Inscrip. of state param.	SEC Password change	tSt Test of display + bargr.	Hour Time change	CLrL Erasing of min. value	CLrH Erasing of max. value				
8	LOGr	rEC Recording	Go_r Start of recording	dAtE Record date.	IntE Record interval						

Fig. 6. Transition matrix into the programming mode

In the table 1 programmable meter parameters are presented. The programming of parameters is possible after the prevous introduction of the password.





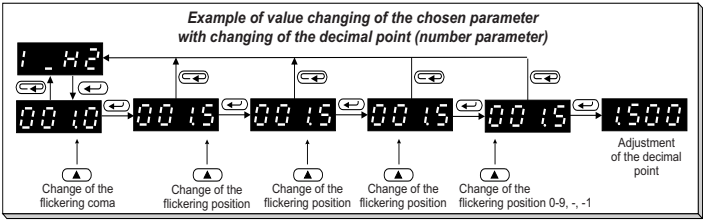


Fig. 7.

Programmable parameters of NA3 meter Table 1

	Symbol on the display	Parameter description	Range of changes
Input parameter Chn	tYP	**Kind of input**	**Reesistance thermometers:** Pt 1 - Pt100 Pt5 - Pt500 Pt 10 - Pt1000 **Thermocouples:** tE-J - thermocouple, type J tE-h - thermocouple, type K tE-n - thermocouple, type N tE-E - thermocouple, type E tE-r - thermocouple, type R tE-S - thermocouple, type S tE-t - thermocouple, type T rE2L - resistance to 400 Ω rE2H - resistance to 4 kΩ mAP - voltage from shunt: 0... 60 mV **Standart signals:** 3U - voltage up to 3 V 0U - voltage up to 10 V 0mAL - current up to 5 mA 0mAH - current up to 20 mA **High signals:** 200U - voltage up to 200 V 600U - voltage up to 600 V 2A - current up to 2 A 5A - current up to 5 A
	Func	**Mathematical functions made in the channel**	OFF - mathematical functions switched off; SQr - raising to a power (result)^2 SQrt - extraction of roots $\sqrt{\text{result}}$

Input parameter CHn	Con	**Kind of compensation** of sensor working conditions changes: - In case of a resistance thermometer and resistance measurement it concerns the compensation of the resistance changes of the conductor linking the sensor with the meter, - In case of a thermocouple it concerns the compensation of reference junction temperature changes. The automatic compensation does not operate in case of a resistance measurement up to **4 kΩ**, **Pt1000** and **Pt100**	Auto - automatic compensation (in case of resistance thermometers and resistance measurement it requires a 3-wire line.) **0.0...60.0°C** - value of the reference temperature for thermocouples. **0.0...40.0 Ω** - resistance of two conductors for resistance thermometers and resistance measurement. The writing of a value beyond the interval of manual compensation will cause the **automatic compensation** switching on.
	d_P	**Setting of the decimal point**. The setting operates both when the individual characteristic is switched off and on. The introduction of the decimal point making impossible the display of four characters on the display will cause the display of the lower or upper exceeding.	Setting possibility: **0000** **000.0** **00.00** **0.000** Auto - automatic choice of the decimal point
	Cnt	**Averaging time of the measurement.**	**0,0...999,9 s** The writing of 0 causes the switching of the measurement off and the stoppage of the meter operation. In this state, the meter displays the hour. The bargraph is blank.
	Ind1	The switching off or on of the individual linear user's characteristic. - („individual characteristic of the display").	On - characteristic switched on, OFF - characteristic switched off. When the characteristic is switched off, the meter operates with the maximal range depending on the kind of input.
	I_H1 d_Y1 I_H2 d_Y2	**Parameters of the display individual characteristic**. On the base of given by the user coordinates of two points the meter determines (from the system of equations) a and b coefficients of the individual characteristic. $\begin{cases} d_Y1 = a \cdot I_H1 + b \\ d_Y2 = a \cdot I_H2 + b \end{cases}$ Where: I_H1 i I_H2 - measured value d_Y1 i d_Y2 - expected value on the display. Fig.9 shows the way of the individual characteristic operation.	Setting possibility: -1999...9999

Bargraph Parameters bAr	tYPb	**Bargraph type**	OnEC - „ one colour „ bargraph, InTr - „ interval „ bargraph, SEct - „ sector" bargraph, PInt - „ point bargraph, trEn -"trend" bargraph. Fig. 10 explains bargraph types. .
	colr	**Bargraph colour**	OFF - bargraph switched off, r - red, G - green, rG - red + green other colours are accessible only in meters with a 7-colour bargraph. b - blue, rb - red + blue, Gb - green + blue, rGb - red + green + blue.
	brL	**Parameter to set the „magnifier" on the bargraph. Lower threshold**. The value of the input signal at which the bargraph is to be blank.	- 1999... 9999
	brH	**Parameter to set the „magnifier" on the bargraph. Upper threshold**. The value of the input signal at which the bargraph is to be lighted.	- 1999... 9999

Parameters of alarm1, alarm2 and alarm 3	PrL	**Lower alarm threshold**	- 1999... 9999
	PrH	**Upper alarm threshold**	- 1999... 9999
	tYPA	**Alarm type** Fig. 8 shows alarm types	nor - normal, On - switched on, OFF - switched off, H_On - manually switched on. Till the time of the alarm type change, the alarm output is being permanently switched on.

Parameters of alarm1, alarm2 and alarm 3 AL1 AL2 AL3			H_oF - manually switched off. Till the time of the alarm type change, the alarm output is being permanently switched off.
	dLY	**Delay of the alarm operation.** The parameter is defined in seconds, i.e. one must give the time in seconds after which the alarm will operate after its occurrence. The alarm operation follows after the measurement averaging. The alarm switching off follows without delay..	**0.0... 999.9** Introduction of **0.0** causes the operation at the moment of the alarm occurrence.
	HOLd	**Support of alarm signalling**. In the situation when the holding function is switched on, after the alarm state stoppage, the alarm is still switched on (alarm diode, relay or OC contacts). The alarm state is active till the moment of erasing it by means of the combination of [↵] and [⇄] keys. Hold down within ca 3 seconds.	oFF - The maintenance of the alarm output is switched off. on - The maintenance of the alarm output is switched on.
	CurL	**Colour of the lower threshold alarm marker.**	oFF - alarm marker switched off. r - red, G - green, rG - red + green, Other colours are accessible only in meters with a 7-colour bargraph. b - blue, rb - red + blue, Gb - green + blue, rGb - red + green + blue, Fig. 10 explains the idea of CurL and CurH... parameters
	CurH	**Colour of the upper threshold alarm marker.**	

Output parameters Out	indO	Switching off or on of the individual linear user's characteristic - („**individual characteristic of the analog output**").	On - characteristic switched on, OFF - characteristic switched off . When the characteristic is switched off, the meter operates at the maximal range depending on input and range output.
	d-H1 O-Y1 d-H2 O-H2	**Parameters of the individual characteristic of the analog output**. On the base of given coordinates of two points by the user, the meter determines (from the equation system) coefficients a and b of the individual characteristic. $\begin{cases} O_Y1 = a \cdot d_H1 + b \\ O_Y2 = a \cdot d_H2 + b \end{cases}$ where: d_H1 and d_H2 - displayed value O_Y1 and O_Y2 - expected value on the analog output. Fig. 9 represents the graphical illustration explaining the idea of the individual characteristic.	Setting possibility: **- 1999... 9999**
	bAud	**Baud rate of the RS-485 interface**.	2400 - 2400 b/s 4800 - 4800 b/s 9600 - 9600 b/s
	trYb	**Kind of transmission through the RS-485 interface**.	OFF - interface switched off A8n1 - ASCII 8N1 A7E1 - ASCII 7E1 A7o1 - ASCII 7O1 r8n2 - RTU 8N2 r8E1 - RTU 8E1 r8o1 - RTU 8O1 r8n1 - RTU 8N1
	Adr	**Device address**	0...247

Servicing parameters SEr	SEt	**Manufacturer's parameters**. Manufacturer's parameters are presented in the table 2.	The pressure of the ↵ key causes the writing of manufacturer's parameters.
	SEC	**Introduction of a new password**.	**- 1999... 9999**
	tSt	**Test of displays**. The test consists on a successive display of numbers 1111, 2222 etc. Successive bargraph colours are lighted on the bargraph.	The pressure of the ↵ key causes the test switching on. The pressure of the ↵ key ends the test.
	Hour	**Setting of the current time**. Time format : hh:mm:ss	**00:00:00 ... 23:59:59**
	CLrL	**Erasing of the minimal value**.	The pressure of the ↵ key causes the erasing of the minimal value.
	CLrH	**Erasing of the maximal value**.	The pressure of the ↵ key causes the erasing of the maximal value.

Recording parameters rECr	rEC	**Switching the recording on or off**. At the moment of switching the recording on, the meter erases the previous stored values.	On - recording switched on OFF - recording switched off
	Go-r	**Hour of recording start** Time format: hh:mm:ss	**00:00:00 ... 23:59:59**
	dAtE	**Date of recording start** Date format: yy.mm.dd It is an information parameter. It not serves to define the date from which the recording is to begin, but only to inform when the recording has began.	**70.01.01 ... 38.12.31**
	intE	**Time interval of recording** - Defines the segment of time and at which sequence the result will be to memorised. Minimal interval 1 s. Format: hh:mm:ss	**00:00:00 ... 99:59:59**

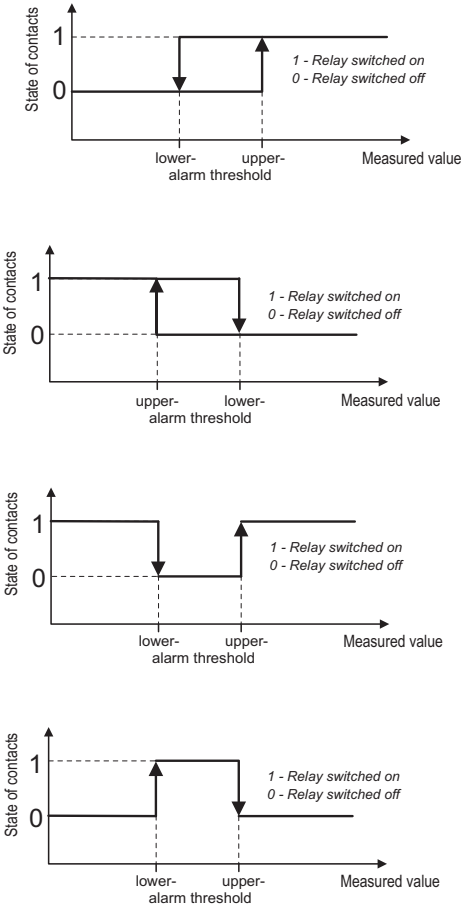
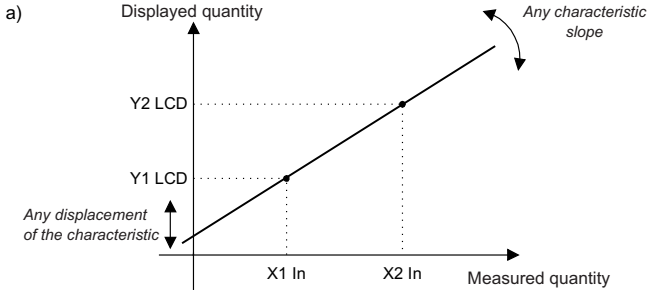
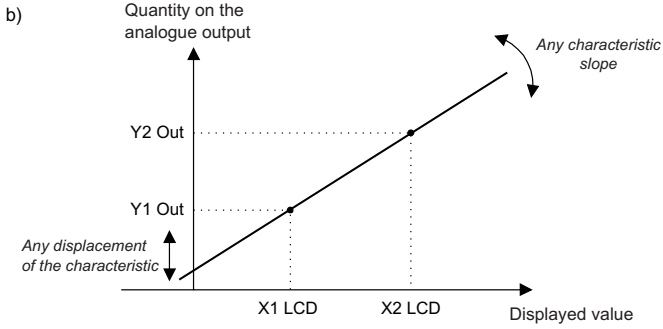


Fig. 8. Alarm types: a, b - normal, c - switched off, d - switched on



Value I_H1 on the meter input => d_Y1 on the display.
Value I_H2 on the meter input => d_Y2 on the display
other points of the characteristic are evaluated



Value d_H1 on the display => 0_Y1 on the analogue output.
Value I_H2 on the display => d_Y2 on the analogue output
other points of the characteristic are evaluated

Fig. 9. Individual characteristic of the display a) and analogue output b).

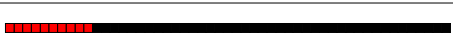
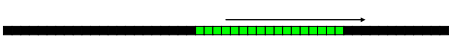
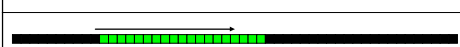
Type of bargraph	Examplary settings of the bargraph and the alarm, ex. 1 CurL =G (green) CurL = r (red) CurH= rG (red + green)	Notes
OnEC		
InEr		Value under the value PrL
		Value between PrL and PrH
		Value over PrH
SEcE		
PI nE		
trEn		Value without changes in time
		Value increases
		Value decreases

Fig. 10. Bargraph modes.

NOTE!

– In case of the meter working with a resistance thermometer in a two-wire system, the choice of the automatic compensation of conductor resistance changes will cause a meter defective work.

– The automatic compensation is switched off when choosing Pt1000, Pt500 sensors and at measuring the resistance up to 4 kΩ. Connect the signal only in the two-wire system.

– In case of switching the display individual characteristic on, the result on the display is lineally converted in accordance with the introduced **I_H1**, **I_H2**, **d_Y1** and **d_Y2** parameters.

– In case of switching the analogue output individual characteristic on, the measurement result is lineally converted in accordance with the introduced **d_H1**, **d_H2**, **O_Y1** and **O_Y2** parameters.

– The meter checks currently the value of the introduced parameter. In case when the introduced value exceeds the upper or lower change range given in the table 1, the meter will not make the parameter record.
– In case of the **Input type** change, a simultaneous change of the decimal point follows, optimally for the given input.
– After the supply decay, the current time is reset.
– The switching of the record off follows in following cases: switching the record off from the programming matrix, change of the input kind, change of Go_r , change of IntE, setting Cnt=0, memory filling up and when the meter is switched to the network on again.
– In case of the Intr or Sect bargraph type, the setting of Curl and Curh markers (from one alarm) is possible. The others are automatically erased.
– Max. and min. values are erased in case of following changes: input type, individual characteristic (on, off), entry of standard parameters.

Standard parameters of the NA3 meter Table 2

Parameter description	Standard value	Parameter description	Standard value
tYP	Pt100	HOLd	OFF
FunC	OFF	CurL	r
Con	0 = manual	CurH	rG
d_P	0000.0	Ind0	OFF
Cnt	1.0	d_H1	0
Ind1	OFF	0_Y1	
1_H1	0	d_H2	
d_Y1		0_Y2	
1_H2		bAud	9600
d_Y2		trYb	RTU 8N2
tYPb	Sect	Adr	1
colr	G	SEC	0
brL	- 200	Hour	00:00:00
brH	850	rEC	OFF
PrL	- 200	Go_r	00:00:00
PrH	850.0	dAtE	70.01.01
tYPA	OFF	IntE	00:15:00
dLY	0		

6. RS-485 INTERFACE

NA3 programmable digital meters have a serial link of RS-485 standard to communicate in computer systems and with other devices fulfilling the master function. The MODBUS asynchronous character communication protocol has been implemented on the serial link. The transmission protocol describes information exchange procedures between devices through the serial link.

6.1. Procedure of the serial interface connection

The RS-485 standard enables the direct connection to 32 devices on a single serial link up to a 1200 m distance. For the connection of a higher number of devices it is necessary to apply additional intermediate-to-separating systems.

The exit of the interface line is presented in the service manual on the fig. 3.d. In order to obtain a correct transmission it is necessary to connect lines **A** and **B** in parallel to their equivalent lines in other devices.

The connection must be made with a shielded conductor. The shield must be connected to the protective terminal in one point.

The **GND** line serves to the additional protection of the interface line at long distance connections.

One must connect GND signals between devices and one point to the protective terminal (that is not necessary for the interface correct operation).

To obtain the connection with the computer of IBM PC class, an RS-232 into RS-485 converter of PD5 type is necessary or an RS-485 interface card. The way of NA3 meter connection through the PD5 converter is shown on the fig. 3d.

The designation of transmission lines for the card in the PC computer depends on the card producer.

6.2. Description of the MODBUS protocol implementation

The implemented protocol is in accordance with the PI-MBUS-300 Rev G Modicon company specification.

The set of parameters of the meter serial link in the MODBUS protocol:

– meter address	1... 247
– baud rate	2400, 4800, 9600 bit/s
– working mode	ASCII, RTU
– information unit	ASCII: 8N1, 7E1, 7O1 RTU: 8N2, 8N1, 8E1, 8O1
– maximal response time	300 ms

The configuration of serial link parameters is described in the further part of this service manual. It consists on the settlement of the baud rate (**Baud** parameter), device address (**Adr** parameter), and the type of the information unit (**Tryb** parameter)

Note: Each meter connected to the communication network must:

- have a unique address, different from addresses of other devices connected to the network
- the identical baud rate and the type of the information unit.

6.3 Description of the MODBUS protocol function

Following functions of the MODBUS protocol have been implemented in NA3 meters:

Function description Table 3

Code	***Meaning***
03 (03 h)	Read-out of n-registers
06 (06 h)	Recording of a single register
16 (10 h)	Recording of n-registers
17 (11 h)	Identification of the slave device

Note:

In NA3 meters the answer response frame to the function 17 is as follows:

Device address	Function	Number of bytes	Device identifier	Device state	Field depending on the type of device	Check-sum
X	11	08	X	FF	XXXXXX	

Read-out of n-registers (code 03 h)

The function is inaccessible in the publication mode.

Example: read-out of 2 registers starting from the register which the address is 1 DBDh (7613) in RTU mode.

Request:

Device address	Function	Register address Hi	Register address Lo	Number of registers Hi	Number of registers Lo	Check-sum CRC
01	03	1D	BD	00	02	52 43

Response:

Device address	Function	Number of bytes	Value from the register 1DBD (7613)				Value from the register 1DBE (7614)				Check-sum CRC
01	03	08	3F	80	00	00	40	00	00	00	42 8B

Recording of values into the register (code 06h)

The function is accessible in the publication mode.

Example: recording of the register which address is 1DBDh (7613) in RTU mode.

Request:

Device address	Function	Register address Hi	Register address Lo	Value from the register 1DBD (7613)				Check-sum CRC
01	06	1D	BD	3F	80	00	00	85 AD

Response:

Device address	Function	Register address Hi	Register address Lo	Value from the register 1DBD (7613)				Check-sum CRC
01	06	1D	BD	3F	80	00	00	85 AD

Recording into n-registers (code 10h)

The function is accessible in the publication mode

Example: recording of 2 registers starting from the register which address is 1DBDh (7613) in RTU mode.

Request:

Device address	Function	Register address Hi	Register address Lo	Number of registers Hi	Number of registers Lo	Number of bytes	Value for the register 1DBD (7613)				Value for the register 1DBE (7614)				Check-sum CRC
01	10	1D	BD	00	02	08	3F	80	00	00	40	00	00	00	03 09

Response:

Device address	Function	Register address Hi	Register address Lo	Number of registers Hi	Number of registers Lo	Check-sum (CRC)
01	10	1D	BD	00	02	D7 80

Report identifying devices (code 11h) in RTU mode.

Example: the read-out.of data identifying the device for NA3 meter with a universal input

Request:

Device address	Function	Checksum (CRC)
01	11	C0 2C

Response:

Device address	Function	Number of bytes	Device identifier	Device state	Field depending on the type of device	Check-sum
01	11	08	80	FF	00XXXXX	

Device address - depending on the set point

Function - no of function 0 x 11

Number of bytes - 0x08

Device identifier
- 0x80 - NA3 with universal input (NA3-XXXU)
- 0x85 - NA3 with temperature input (NA3-XXXT)
- 0x86 - NA3 with standard input (NA3-XXXS)
- 0x87 - NA3 with high signal input (NA3-XXXH)

Device state - 0xFF

Field depending on the device type - XXXXXX

Device name - transmitted as ASCI character and defines the meter type:
- U - 0x55, 55 X X X X X
- T - 0x54, 54 X X X X X
- S - 0x53, 53 X X X X X
- H - 0x48, 48 X X X X X

Analogue output - field depending on the type of the analogue output
- 0x00 - lack of analogue output, X 00 X X X X
- 0x01 - voltage analogue output, X 01 X X X X
- 0x02 - current analogue output, X 02 X X X X

No. of the software version - software version implemented in the meter
- X X_ _ _ _4 - byte variable of float type

Checksum - 2 bytes in case of work in RTU mode
- 1 byte in case of work in ASCII mode

Example:
Work in **RTU** mode, e.g.: **Mode = RTU 8N2** (value 0x02 in case of readout/record through the interface).
NA3 meter with an universal input (NA3-XXXU)
Execution with a voltage analogue output: **00**,
No. of the software version: **1.00**,
Device address set on: **Adr = 0 x 01**,

For such a meter the frame has the following form:

Device address	Function	Number of bytes	Device identifier	Device state	Field depending on the device type	Check-sum (CRC)
01	11	08	80	FF	00 00 3F 80 00 00	3F 1B

6.4. Register map of NA3 meters

Register map of NA3 meters Table 4.

Address range	***Type of value***	***Description***
7000-7200	Float (32 bits)	The value is placed in two successive 16-bytes registers. Registers enclose the same data as 32-bytes registers from the 7500 area. Registers are only for readout.
7200-7400	Float (32 bits)	The value is placed in two successive 16-bit registers. Registers enclose the same data as 32-bit registers from the 7600 area. Registers can be readout and written.
7500-7600	Float (32 bits)	The value is placed in a 32-bytes register. Registers are only for readout.
7600-7700	Float (32 bits)	The value is placed in a 32-bit register. Registers can be read out and written.

6.5. Registers for recording and readout

NA3 meter

The value is placed in two successive 16-bit registers enclosing the same data as 32-bit registers from the 7600 area	The value is placed in 32-bit registers	Symbol	Writing (w) Readout (r)	Range	Description
7200	7600	**Identifier**	r	-	Device identifier

Value	
80	NA3 with universal input „U”
85	NA3 with temperature input „T”
86	NA3 with standard input „S”
87	NA3 with high signal input „H”

7202	7601	**Channel number**	w/r	0...1	No occurs
7204	7602	**Output type**	w/r	0...20	Input type

Value	
0	Pt100 RTD
1	Pt500 RTD
2	Pt1000 RTD
3	J thermocouple
4	K thermocouple
5	N thermocouple
6	E thermocouple
7	R thermocouple
8	S thermocouple
9	T thermocouple
10	R. meas. up to 400 Ω
11	R. meas. up to 4 kΩ
12	Volt. meas. 0... 60 mV
13	Volt. meas. 0... 3 V
14	Volt. meas. 0...10 V
15	Current meas. 0... 5 mA
16	Current meas. 0... 20 mA
17	Volt. meas. 0... 200 V
18	Volt. meas. 0... 600 V
19	Current meas. 0...2 A
20	Current meas. 0...5 A

7206	7603	**LoIn**	w/r	-1999... 9999	No occurs	
7208	7604	**HiIn**	w/r	-1999... 9999	No occurs	
7210	7605	**Function**	w/r	0... 2	Arithmetical function	
					Value	
					0	Switched off
					1	Squaring
					2	Extraction of roots
7212	7606	**Compens.**	w/r	-199.9... 999.9	Compensation of the conductor resistance	
7214	7607	**D_P**	w/r	0... 4	Decimal point	
					Value	
					0	0000
					1	000.0
					2	00.00
					3	0.000
					4	Auto
7216	7608	**Cnt**	w/r	0... 999.9	Measurement time	
7218	7609	**Indi**	w/r	0... 1	Individual characteristic	
					Value	
					0	Switched characteristic off
					1	Switched characteristic on
7220	7610	**X1 In**	w/r	-1999... 9999	Parameters of the individual characteristic	
7222	7611	**Y1 LED**	w/r	-1999... 9999	Parameters of the individual characteristic	
7224	7612	**X2 In**	w/r	-1999... 9999	Parameters of the individual characteristic	
7226	7613	**Y2 LED**	w/r	-1999... 9999	Parameters of the individual characteristic	
7228	7614	**Bargraph number**	w/r	0... 1	No occurs	
7230	7615	**Bargraph type**	w/r	0... 4	Bargraph type	
					Value	
					0	One-colour (**OnEC**)
					1	Change of colour after exceeding the alarm threshold (the colour change the whole bargraph) (**Intr**)

					2 Change of colour after exceeding the alarm threshold (Three-segment change of colour) (**SEct**)
					3 One-coloured bargraph, alarm markers in another colour (**PInt**)
					4 Increasing/decreasing trend (**trEn**)
7232	7616	**Colour**	w/r	0... 7	Bargraph colour
					Value
					0 Bargraph off (**OFF**)
					1 Red (**r**)
					2 Green (**G**)
					3 Red + Green (**rG**)
					Other values are only accessible in meters with RGB diodes
					4 Blue (b)
					5 Red + Blue (rb)
					6 Green + blue (Gb)
					7 Red + Green + Blue (rGb)
7234	7617	**Brl**	w/r	-1999... 9999	„Magnifier „on the bargraph. Lower threshold
7236	7618	**Brh**	w/r	-1999... 9999	„Magnifier „on the bargraph. Upper threshold
7238	7619	**Alarm number**	w/r	0... 2	Choice of alarm number
					Range of changes is depended on the meter execution code (number of alarms)
7240	7620	**Ch_Alarm**	w/r	0... 1	No occurs
7242	7621	**Prl**	w/r	-1999... 9999	Alarm lower threshold <**Alarm No**>
7244	7622	**Prh**	w/r	-1999... 9999	Alarm upper threshold <**Alarm No**>
7246	7623	**Type a**	w/r	0... 4	Alarm type <**Alarm No**>
					Value
					0 Normal
					1 Switched on
					2 Switched off
					3 Manually switched on
					4 Manually switched off

7248	7624	**Alarm delay**	w/r	0... 999.9	Alarm delay <**Alarm No**>	
7250	7625	**Alarm support**	w/r	0... 1	Alarm signalling support <**Alarm No**>	
					Value	
					0	Support switched off
					1	Support switched on
7252	7626	**CURL**	w/r	0... 7	Bargraph colour for the lower alarm threshold	
					Value	
					0	Bargraph switched off (**OFF**)
					1	Red (**r**)
					2	Green (**G**)
					3	Red + Green (**rG**)
					Other values accessible only in meters with RGB diodes	
					4	Blue (**b**)
					5	Red + Blue (**rb**)
					6	Green + blue (**Gb**)
					7	Red + Green + Blue (**rGb**)
7254	7627	**CURH**	w/r	0... 7	Bargraph colour after exceeding the upper alarm threshold <**Alarm No**>	
					Value	
					0	Bargraph switched off (**OFF**)
					1	Red (**r**)
					2	Green (**G**)
					3	Red + Green (**rG**)
					Other values accessible only in meters with RGB diodes	
					4	Blue (**b**)
					5	Red + Blue (**rb**)
					6	Green + blue (**Gb**)
					7	Red + Green + Blue (**rGb**)
7256	7628	**Chna**	w/r	0... 1	No occurs	
7258	7629	**Output characteri-stic**	w/r	0... 1	Characteristic of the analogue output	
					Value	
					0	Characteristic switched off
					1	Characteristic switched on

7260	7630	**X1 LED**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7262	7631	**Y1 Out**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7264	7632	**X2 LED**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7266	7633	**Y2 Out**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7268	7634	**Baud rate**	w/r	0... 2	Baud rate of the RS-485 interface	
					Value	
					0	2400 bit/s
					1	4800 bit/s
					2	9600 bit/s
7270	7635	**Working mode**	w/r	1... 7	Working mode of the MODBUS protocol	
					Value	
					1	ASCII 8N1
					2	ASCII 7E1
					3	ASCII 7O1
					4	RTU 8N2
					5	RTU 8E2
					6	RTU 8O2
					7	RTU 8N1
7272	7636	**Address**	w/r	0... 247	Choice of the device address	
7274	7637	**Test**	w/r	0... 1	Test of the display	
					Value	
					0	Lack of operation
					1	Test
7276	7638	**Hour**	w/r	0... 23.5959	Current time	
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds In case when introducing and incorrect time, the indicator will correct it automatically.	
7278	7639	**Recording**	w/r	0... 1	Registration of measured value	
					Value	
					0	Registration switched off
					1	Registration switched on

7280	7640	**Interval**	w/r	0... 99.5959	Time interval of the recording
7282	7642	**Recording time**	w/r	0... 23.5959	Time of the recording start
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds In case when introducing and incorrect time, the indicator will correct it automatically.
7284	7642	**Year**	w/r	1970... 2038	Year of the recording start
7286	7643	**Month**	w/r	1... 12	Month of the recording start
7288	7644	**Day**	w/r	1... 31	Day of the recording start
					Year, Month, Day are information parameters. They do not serve to define the date from which the recording is to be start, but only to inform since when the recording has started.
7290	7645	**Erasing of minimum Channel 1**	w/r	0... 1	Erasing of the minimal value
					Value |
					0 | Lack of operation
					1 | Erasing
7292	7646	**Erasing of maximum Channel 1**	w/r	0... 1	Erasing of the maximal value
					Value |
					0 | Lack of operation
					1 | Erasing
7294	7647	**Erasing of minimum Channel 2**	w/r	0... 1	No occurs
7296	7648	**Erasing of minimum Channel 2**	w/r	0... 1	No occurs

7320	7660	**Year of the memorised value**	w/r	1970... 2038	Year of memorised value in memory
7322	7661	**Month of the memorised value**	w/r	1... 12	Month of memorised value in memory
7324	7662	**Day of the memorised value**	w/r	1... 31	Day of memorised value in memory

7326	7663	**Time of the memorised value**	w/r	0... 23.5959	Time of memorised value in memory
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds In case when introducing and incorrect time, the meter will correct it automatically.
7328	7664	**Index of the memorised value**	w/r	1... 750	Number of memorised value in memory
7230	7665	**Status**	w/r	0... 8	Operation status on the buffer

Value	
0	Lack of operation
1	Searching acc. date and time (registers nr 7660...7663 and 7320...7326)
2	Searching acc. time (registers nr 7663 and 7326)
3	Searching acc. index (registers nr 7664 and 7328)
4	Load next values into the buffer (registers7672...7691and 7344...7382)
5	Load previous values into the buffer (registers7672...7691 and 7344...7382)
6	Go to the first memorised value in memory.

					7	Go to the last memorised value in memory.
					8	Erase the memory
7332	7666	**Number of the memorised value**	r	0... 750	Number of memorised value in memory, placed in the first buffer register	
					Value	
					0	Memory is empty
					1... 750	Number of the memorised value
7334	7667	**Number of recorded registers**	r	0... 750	Number of recorded buffer registers	
					Value	
					0	Buffer is empty
					1... 750	Number of recorded registers
7336	7668	**Year**	r	1970... 2038	Year for the value in the first register	
7338	7669	**Month**	r	1... 12	Month for the value in the first register	
7340	7670	**Day**	r	1... 31	Day for the value in the first register	
7342	7671	**Time**	r	0... 23.5959	Time for the value in the first register	
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds	
7344...7382	7672... 7691	**Buffer**	r	–	Memorised values, read out from the memory	
					20 registers , including 20 memorised values.	

1) In case of registers not occurring in the given meter series, their value is:1E+20

6.6. Registers only for readout

NA3 meter

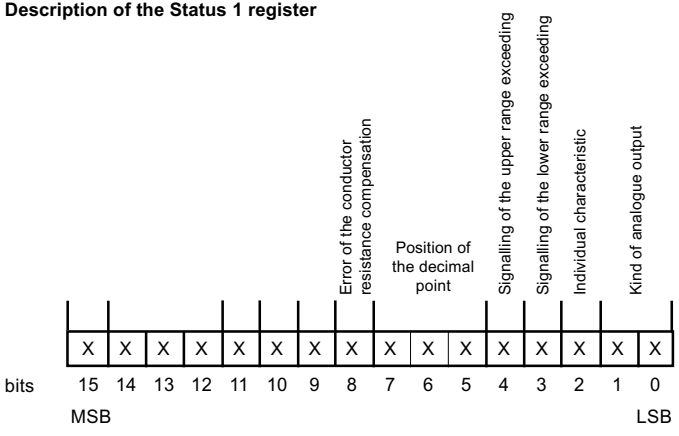
The value is placed into two successive 16-bite registers. These registers include the same data as 32-bite registers from the area 7500.	The value is placed into 32-bite registers	Name	Writing (w) Readout (r)	Unit	Quantity name
7000	7500	**Identifier**	r	-	Constant identifying the device
7002	7501	**Status 1**	r	-	Register describing the current state of the meter
7004	7502	**Status 2**	r	-	Register describing the current state of the meter
7006	7503	**Steering out**	r	%	It is the register defining the control procedure of the analogue output (controllability)
7008	7504	**Min 1**	r	-	Minimal value of the currently measured value of channel 1
7010	7505	**Max 1**	r	-	Maximal value of the currently measured value of channel 1
7012	7506	**Value 1**	r	-	Currently measured value of channel 1
7014	7507	**Hour**	r		Current time
7016	7508	**Min 2**	r	-	No occurs
7018	7509	**Max 2**	r	-	No occurs
7020	7510	**Value 2**	r	-	No occurs

1) In case of registers no occurring in the given meter series, their values is 1E+20

Note !

– At the moment of exceeding the upper or lower range, „displayed value", „minimum", „maximum" parameters are set on the value 1E+20.
– For the parameter **Cnt**=0 (Measurement switching off and display of the current time), „minimum", „maximum" and „displayed value" parameters are set on the value 1E+20.

Description of the Status 1 register



Bit-8 Error of the conductor resistance compensation

0 - Lack of error

1 - Signalling of compensation error

Bit-7...5 Position of the decimal point

000 - lack

001 - 000.0

010 - 00.00

011 - 0.000

100 - Auto

Bit-4 Signalling of the upper range exceeding

0 - normal work

1 - range exceeding

Bit-3 Signalling of the lower range exceeding

0 - normal work

1 - range exceeding

Bit-2 Individual characteristic

0 - individual characteristic switched off

1 - individual characteristic switched on

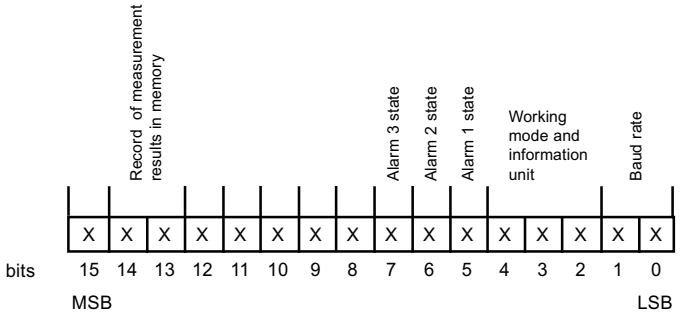
Bit-1...0 Kind of output (voltage, current)

00 - lack of analogue output

01 - current

10 - voltage

Description of the status 2 register



Bit-15. No used

Bit-14...13 Record of measurement results in memory

0 - Record switched off

1 - Record switched on

Bit-12...8 . No used

Bit-7. State of alarme 3

0 - off

1 - on

Bit-6 State of alarm 2
0 - off
1 - on

Bit-5 State of alarm 1
0 - off
1 - on

Bit-4...2 Working mode and information unit
000 - interface switched off
001 - 8N1 - ASCII
010 - 7E1 - ASCII
011 - 7O1 - ASCII
100 - 8N2 - RTU
101 - 8E1 - RTU
110 - 8O1 - RTU
111 - 8N1 - RTU

Bit-1...0 Baud rate
00 - 2400 bit/s
01 - 4800 bit/s
10 - 9600 bit/s

7. TECHNICAL DATA

INPUTS:

	Range	NA3-XXX**U**	NA3-XXX**T**	NA3-XXX**S**	NA3-XXX**H**
Pt100	(-200... +850)°C	X	X		
Pt500	(-200... +850)°C	X	X		
Pt1000	(-200... +850)°C	X	X		
J (Fe-CuNi)	(-30... +1100)°C	X	X		
K (NiCr-NiAl)	(-50... +1370)°C	X	X		
N (NiCrSi-NiSi)	(-100... +1300)°C	X	X		
E (NiCr-CuNi)	(-20... +850)°C	X	X		
R (PtRh13-Pt)	(0... +1760)°C	X	X		
S (PtRh10-Pt)	(0... +1760)°C	X	X		
T (Cu-CuNi)	(-50... +400)°C	X	X		
Resistance measurement	0...400 Ω	X	X		
Resistance measurement	0...4000 Ω	X	X		
Voltage measurement	0...60 mV	X	X		
Voltage measurement	0...3 V	X			
Voltage measurement	0...10 V	X		X	
Current measurement	0...5 mA	X			
Current measurement	0...20 mA	X		X	
Voltage measurement	0...200 V	X			X
Voltage measurement	0...600 V	X			X
Current measurement	0...2 A	X			X
Current measurement	0...5 A	X			X

Input resistance:

- for voltage inputs > 4 MΩ
- for inputs (5 mA and 20 mA) < 4 Ω
- for inputs (2 A and 5 A) 10 mΩ ±10%

Intensity of current flowing through the resistance thermometer: < 170 μA

Resistance of conductors linking the resistance thermometer with the meter: < 20 Ω /1 wire

Thermocouple characteristics acc. EN 60584-1.

Resistance thermometer characteristics acc. IEC 751 + A1+A2.

OUTPUTS:

– **Analogue output** galvanically isolated, with a resolution = 0,025% of the range

- current programmable: 0/4..20mA	load resistance ≤ 500 Ω
- or voltage programmable: 0..10V	load resistance ≥ 500 Ω
- output response time	100 ms
- output error	0.2 % of the range
- additional error due to ambient temperature changes:	± (0.1% of the range /10K)

– **Relay output**

Relays (1 or 2); voltageless make contacts - maximal load:

voltage	250 V a.c., 150 V d.c.,
current	5 A 30 V d.c., 250 V a.c.,
resistance load	1250 VA, 150 W.

Programmable alarm thresholds;

Three types of alarms;

Hysteresis defined by means of the lower and upper alarm threshold;

Signalling of alarm operation on the bargraph or by means of alarm diodes.

– **Output of open collector (OC) type**

voltageless, OC type with npn transistor (max. load 25 mA)

range of added voltage: 5...24 V d.c.

– **Digital output:**

interface:	RS-485,
transmission protocol:	MODBUS,
ASCII:	8N1, 7E1, 7O1,
RTU:	8N2, 8E1, 8O1, 8N1,
baud rate:	2400, 4800, 9600 baud
maximal response time to the request frame:	300 ms.

Memory parameters:

- meter memory (record)	750 samples
- min. record interval	1 sec;

Basic error: 0.2% ±1 digit

Additional errors in nominal working conditions when measuring the temperature:

- compensation of reference junction temperature changes	± 0.2 % of range
- compensation of wire resistance changes	± 0.2 % of range
Additional error from ambient temperature changes	± (0.1 % of range/10K)
Averaging time	min 500 ms, temperature measurement min 200 ms, other ranges

Rated operation conditions:

- supply voltage depending on the execution code	95...230...253 V a.c./d.c. 20...24...40 V a.c./d.c.
- supply a.c. voltage frequency	40...50/60...440 Hz
- ambient temperature	- 10...23...55°C
- storage temperature	- 25...+85°C
- relative humidity	< 95% (no condensation)
- time of preliminary indicator heating	10 min

Sustained overload:

- thermocouples, resistance thermometers	1 %
- measurement of voltage, current and resistance	10 %

Momentary overload (3 s):

- sensor inputs and voltage 60 mV	30 V
- voltage input >= 3 V	10 × Un (< 1000 V)
- current input	10 × In
Readout field (depending on execution):	4 seven-segment LED display, NA3-F digit height: 7 mm NA3-D digit height: 14 mm NA3-B without display indication range: -1999...9999

	bargraph length: 82 mm (except NA3-D) - 45 segments in three-colour execution - 25 segments in seven-colour execution
	3 alarm diodes in NA3D execution
Bargraph resolution	programmable
Bargraph accuracy	± 0.5 segment
Servicing:	three keys:
Ensured protection degree (EN 60529):	
- through the casing	IP 40
- from terminal side	IP 20
Dimensions:	96 x 24 x 125 mm (with terminals)
Weight:	< 0.3 kg
Power consumption	< 8 VA
Resistance against supply decay	acc. EN 61000-6-2:2002
Electromagnetic compatibility:	
- immunity	EN 61000-6-2:2002
- emission	EN 61000-6-4:2002
- additional error from electromagnetic risks	< 0.5%
Safety requirements according EN 61010-1:	
- installation category	III
- pollution degree	2
- phase-to-earth max. working voltage:	
input	600 V
supply	300 V
relays	300 V
analogue output	50 V
RS-485	50 V

8. BEFORE A FAILURE WILL BE DECLARED

In case of incorrect symptoms please to acquaint with the table below.

SYMPTOMS	PROCEDURE
1. Lack of indications on the display. The bargraph indicates nothing.	Check the connection of the feeder cable.
2. The time is displayed on the display, e.g. **H_12** alternately with **34:43**.	The number of measurements **Cnt** = 0 has been introduced. The meter is working in the SLEEP mode. It displays the current hour.
3. Marks or are displayed on the display.	Check the correctness of the input signal connection. See the service manual. Check also the setting of parameters **D_P** and **Ind**.
4. A signal inconsistent with our expectations occurs on the meter analogue output.	One must check if the load resistance of the analogue output is in accordance with technical data. Check if the individual characteristic is not switched on. In case of necessity make changes of individual characteristic parameters or introduce manufacturer parameters **Set**.
5. Lack of possibility to enter into the programming mode. The inscription **Err** is displayed.	The programming mode is protected by a password. When the user forgets which password has been introduced, he should contact by phone the manufacturer or the nearest authorised workshop.
6. Lack of certainty if all segments of the display or bargraph are efficient.	Enter into the programming matrix and switch the display and bargraph **tSt** test on. Character fields are lighted successively from 0000 to 9999. In the same time the bargraph is lighted with successive colours. If some of segments are not lighted or diodes have different colours, one must submit these defects to the nearest workshop.
7. During the operation in the programming mode, parameter values inconsistent with the range of changes given in the table 1, appear on the display.	Enter into the programming matrix and accept the **SEt** parameter. The meter will introduce values in accordance with the table 2.

8. A result inconsistent with our expectations appears on the display.	Check if the individual characteristic is not switched on. In case of necessity enter into the programming matrix and accept the **SEt** parameter. The meter will introduce parameters in accordance with the table 2.
9. The bargraph does not work in accordance with our expectations.	Check bargraph parameters. In case of a further incorrect operation, enter into the programming matrix and accept the parameter **SEt**. Switch the display and bargraph **tSt** test on.
10. Despite the exceeding of the alarm threshold the alarm relay does not switch on.	Check the delay of alarm operation introduced into the meter. In case of need, correct **dLY** parameters.
11. The meter, instead of displaying the measurement result, displays the parameter symbol and its value.	The meter is working in the preview mode or in the programming mode. Press the escape key (ESC).
12. Despite of the introduced delay in the alarm operation, e.g. 30 seconds, the alarm after this time did not operate.	The lasting alarm state was shorter than the programmed, that means that during the lasting time, the alarm withdrawal state occurred. In such a case, the meter begins to count down the time from the beginning.
13. The meter does not establish the communication with the computer through the RS-485 interface.	Check if interface conductors (**A**, **B**, **GND**) were correctly connected. Then, check in the programming matrix the setting of the interface (**bAud**, **trYb**, **Adr**). These parameters must be the same as in the used software.

9. EXAMPLES OF NA3 METER PROGRAMMING

Example 1. Programming of the individual characteristic.

If we want to programme so that to the value 4.00 mA will correspond the value 0 on the display, whereas, the value 20.00 mA will correspond to the value 100, one must:

- enter into the programming mode and choose the **D_ P** parameter responsible for the decimal point. Set the decimal point on **00000**
- choose the **Ind** parameter and switch the individual characteristic **On**
- choose the **I_H1** parameter and introduce the value 4.00
- transit on the **d_Y1** parameter and introduce the value 0

- transit on the **I_H2** parameter and introduce the value 20.00
- transit on the **d_Y2** parameter and introduce the value 100

Example 2 Programming of an inverse individual characteristic.

If we want to programme so that to the value 4.00 mA will correspond the value 120.5 on the display, and to the value 20.00 mA, the value 10.8, one must:

- enter into the programming mode and choose the **D_P** parameter responsible for the decimal point. Set the decimal point on **0000.0**
- choose the wybrać **Ind** parameter and switch the individual characteristic **On**
- choose the **I_H1** parameter and introduce the value 4.00
- transit on the **d_Y1** parameter and introduce the value 120.5
- transit on the **I_H2** parameter and introduce the value 20.00
- transit on the **d_Y2** parameter and introduce the value 10.8

Example 3 Programming of the alarm with hysteresis

If we want to programme the alarm 1 operation so that at the value 850°C, this alarm will be switched on, whereas it will be switched off at the value 100°C, and the alarm 2 operation so that at the value 1000°C, this alarm will be switched off and switched on at the value -199°C, one must:

- enter into the programming mode , choose the **PrL** parameter of the alarm 1 and introduce the value 100
- transit on the **PrH** parameter of the alarm 1 and introduce the value 850
- transit on the **tYPA** parameter of the alarm 1 and choose select the function assigned as **nor**
- transit on the **tYPA** parameter of the alarm 2 and select the function **nor**
- choose the **PrL** parameter of the alarm 2 and introduce the value 1000
- transit on the **PrH** parameter of the alarm 2 and introduce the value -199

Example 4 Programming of an alarm operating in a set interval with delay.

If we want that the alarm 1 will be switched on in the interval from 100 V to 300 V and operate only after 10 seconds, one must:

- enter into the programming mode , choose the **PrL** parameter of the alarm 1 and introduce the value 100
- transit on the **PrH** parameter of the alarm 1 and introduce the value 300
- transit on the **tYPA** parameter of the alarm 1 and select the function **On**
- transit on the **dLY** parameter of the alarm 1 and introduce the value 10.0

in case of the alarm state duration for a time longer than 10 seconds, the meter will switch the alarm relay on

Example 5 Programming of an analogue output

If we want to programme so that to the displayed value 0.00 mA for the channel 2 will correspond the value 4.00 on the analogue output, whereas to the value 20.00 mA , the value 20.00 mA, one must:

- enter into the programming mode, choose the **IndO** parameter and switch the individual characteristic **On**
- choose the **d_H1** parameter and introduce the value 0.00
- transit on the **O_Y1** parameter and introduce the value 4.00
- transit on the **d_H2** parameter and introduce the value 20.00
- transit on the **O_Y2** parameter and introduce the value 20.00

Example 6 Programming of the recording every 20 seconds since 12:30:

- enter into the programming mode, choose the **Go_r** parameter and introduce the value 12:30
- transit on the **IntE** parameter and introduce the value 00:00:20
- choose the rEC parameter and switch the recording **On**

After the exit from the programming matrix the memory will be erased and the meter will begin to record results since 12:30, every 20 seconds.

After the memory filling up, the recording will be switched off.

10. ORDERING PROCEDURE

Execution codes of NA3 meter (seeTable 5).

Table 5.

NA3 METER WITH BARGRAPH	X	X	X	X	X	X	X	X	XX	X

Meter execution:
With bargraph and LED digital display ..... **F**
With bargraph* ..... **B**
With digital display ..... **D**

Bargraph colour (in case of **D** execution, write **0**):
3-colour (R, G, R + G) ..... **T**
7-colour (R, G, B, R+G, R+B, G+B, R+G+B) ..... **M**

Display colour (in case of **B** execution, write **0**):
red ..... **R**
green ..... **G**
blue ..... **B**

Input signal (table 6):
universal input ..... **U**
temperature input**** ..... **T**
standard input (10 V, 20 mA) ..... **S**
high signal input (200 V, 600 V, 2 A, 5 A) ..... **H**
on order** ..... **X**

Analogue output signal:
without analogue output **0**
current programmed, 0/4...20 mA **1**
voltage programmed, 0...10 V **2**
on order** ..... **X**

Additional outputs:
Without output* **0**
RS-485 digital output + 1 relay **1**
RS-485 digital output + 1 OC output **2**
2 relays* **3**
2 OC outputs* **4**
on order** ..... **X**

Supply:
95...253 V a.c./d.c. **1**
20... 40 V a.c./d.c. **2**
on order** ..... **X**

Kind of terminals:
socket - screw plug **0**
on order*** ..... **X**

Execution:
standard **00**
custom-made** ..... **XX**

Acceptance tests:
without an extra quality inspection certificate **0**
with an extra quality inspection certificate **1**
other requirements** ..... **X**

* In case of NA3 B X X X X (0, 3 or 4) complete the table 7.
** After agreeing with the producer.
*** Possible execution with self-locking terminals.
**** Temperature input signal: Pt100, Pt500, Pt1000, resistance, thermocouple, voltage 0... 60 mV.

Example of ordering:

Code: **NA3 F T R U 0 1 1 0 00 0** means:

F - NA3 meter execution with a bargraph and a digital display,

T - with three colours (R, G, R+G),

R - with a digital display, of red colour

U - universal input (see table 6),

0 - without analogue output signal,

1 - RS-485 digital output + 1 relay,

1 - supply: 95...253 V a.c./d.c.,

0 - socket-screw plug terminals,

00 - standard execution,

0 - without a quality inspection certificate.

In case of a custom-made execution or if you need some more additional technical information, please write to or phone our Export Department.

Input signals Table 6

Universal input	Resistance thermometer:	
	Pt100	(- 200... +850)°C
	Pt500	(- 200... +850)°C
	Pt1000	(- 200... +850)°C
	Thermocouple:	
	J (Fe-CuNi)	(- 30... +1100)°C
	K (NiCr-NiAl)	(- 50... +1370)°C
	N (NiCrSi-NiSi)	(- 100... +1300)°C
	E (NiCr-CuNi)	(- 20... +850)°C
	R (PtRh13-Pt)	(0... +1760)°C
	S (PtRh10-Pt)	(0... +1760)°C
	T (Cu-CuNi)	(- 50... +400)°C
	Resistance	0... 400 Ω
	Resistance	0... 4000 Ω
	Voltage from shunt	0... 60 mV
	Voltage	0... 3 V
	Voltage	0... 10 V
	Voltage	0... 200 V
	Voltage	0... 600 V
	current	0... 5 mA
	current	0... 20 mA
	current	0... 2 A
	current	0... 5 A

Programming of meter parameters Tablica 7.

Kind of output	**tYP**
Mathematical functions	**Func**
Kind of compensation	**Con**
Measurement averaging time	**Cnt**
Display characteristic	**Indi**
Measured value	**I_H1**
Displayed value	**d_Y1**
Measured value	**I_H2**
Displayed value	**d_Y2**
Bargraph type	**tYPb**
Bargraph colour	**coLr**
Bargraph lower threshold	**brL**
Bargraph higher threshold	**brH**
Alarming lower threshold	**PrL**
Alarming higher threshold	**PrH**
Alarm type	**tYPA**
Delay of alarm action	**dLY**
Support of alarm signalling	**HOLd**
Colour of the lower threshold alarm index	**CurL**
Colour of the higher threshold alarm index	**CurH**
Alarming lower threshold	**PrL**
Alarming higher threshold	**PrH**
Alarm type	**tYPA**
Delay of alarm action	**dLY**
Support of alarm signalling	**HOLd**
Colour of the lower threshold alarm index	**CurL**
Colour of the higher threshold alarm index	**CurH**
Alarming lower threshold	**PrL**
Alarming higher threshold	**PrH**
Alarm type	**tYPA**
Delay of alarm action	**dLY**
Support of alarm signalling	**HOLd**
Colour of the lower threshold alarm index	**CurL**
Colour of the higher threshold alarm index	**CurH**
Output characteristic	**IndO**
Displayed value	**d_H1**
Value on the analogue output	**O_Y1**
Displayed value	**d_H2**
Value on the analogue output	**O_Y2**
RS-485 baud rate	**bAud**
Kind of RS-485 transmission	**trYb**
Device address	**Adr**

11. MAINTENANCE AND GUARANTEE

The NA3 meter does not require any periodical maintenance. In case of some incorrect unit operations:

1. From the shipping date, during the period given in the annexed guarantee card

One should take the meter down from the installation and return it to the Manufacturer's Quality Control Dept.

If the unit has been used in compliance with the instructions, the Manufacturer guarantees to repair it free of charge.

2. After the guarantee period:

One should turn over the meter to repair in a certified service workshop.

The disassembling of the housing causes the cancellation of the granted guarantee.

Spare parts are available for the period of five years from the date of purchase.

The Manufacturer policy is one of continuous improvement and we reserve the right to make changes in design and specification of any products as engineering advances or necessity requires and revise the above specification without notice.

SALES PROGRAMME

MEASUREMENT
CONTROL
RECORDING

- DIGITAL and BARGRAPH PANEL METERS
- MEASURING TRANSDUCERS
- ANALOG PANEL METERS (DIN INSTRUMENTS)
- ANALOG and DIGITAL CLAMP-ON METERS
- INDUSTRIAL and HOUSEHOLD CONTROLLERS
- CHART AND PAPERLESS RECORDERS
- POWER CONTROL UNITS and INVERTERS
- AUTOMOTIVE DASHBOARD INDICATORS
- ACCESSORIES FOR MEASURING INSTRUMENTS
- MEASURING SYSTEMS (ENERGY, HEAT, CONTROL)
- CUSTOM-MADE PRODUCTS

WE ALSO OFFER OUR SERVICES IN THE PRODUCTION OF:

- ALUMINIUM ALLOY PRESSURE CASTINGS
- PRECISION ENGINEERING AND THERMOPLASTICS PARTS

QUALITY PROCEDURES:

According to ISO 9001 and ISO 14001 international requirements.
All our instruments have CE mark.
For more information, please write to or phone our Export Department.

LUMEL

Lubuskie Zakłady Aparatów Elektrycznych LUMEL S.A.
ul. Sulechowska 1, 65-022 **Zielona Góra, Poland**

Tel.: (48-68) 32 95 100 (exchange)
Fax: (48-68) 32 95 101
e-mail:lumel@lumel.com.pl
http://www.lumel.com.pl

Export Department:
Tel.: (48-68) 329 51 89
Fax: (48-68) 325 40 91
e-mail: export@lumel.com.pl

February 2004